Reference 2

(19) Japanese Patent Office (JP)

(12) Publication of Unexamined Utility Model Application (U)

(11) Unexamined Utility Model Publication No. 4-25,755

(43) Unexamined Utility Model Publication Date: February 28, 1992

(51) Int. Cl.[5]:	Identification Code	Internal File No.:
A 61 M 29/02		8718-4C

Request for Examination: Not yet made No. of Claims: 1 (Total pages:)

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(54) Title of the Utility Model: **Recoverable Stent**

(21) Utility Model Application No.: 2-66,519

(22) Utility Model Application Date: June 22, 1990

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SPECIFICATION

1. Title of the Utility Model

RECOVERABLE STENT

2. Claim

Recoverable stent, characterized in that it consists of at least two cylinders formed by wave-shaped wires with their ends connected; the peaks and valleys of said wave-shaped wires have narrowed parts formed in them; the valleys of one of the said cylinders are connected by wires to the peaks of the other cylinder; the connecting part of at least one of these peaks and valleys is engaged by a ring; and rings are formed in the outer peaks or valleys.

3. Detailed Description of the Utility Model

[Field of Industrial Application]

The present utility model pertains to a novel recoverable stent; more specifically, it pertains to a recoverable stent which makes it possible to recover a stent with an expanded diameter in a catheter sheath when its location is changed to another desired place after it has been released from the catheter sheath in a blood vessel, bile duct, or ureter.

[Prior Art]

In recent years, percutaneous transluminal coronary angioplasties (PTCA), or percutaneous transluminal angioplasties (PTA), have come to be performed frequently. Treatments using balloon catheters have come to be performed, in particular, in cases of stenosis of blood vessels or advanced atheromas of coronary arteries, cases of gallstones or benign or malignant tumors (cancer) in the bile duct, or cases in which renal calculi have entered the ureter or benign or malignant tumors (cancer) have advanced so that the ureter is almost completely blocked, as well as cases of hard atheromas with advanced organization.

In these therapeutic methods using balloon catheters, a guide wire is first pushed into the blood vessel and advanced to the target stenosis. A balloon catheter is passed along this guide wire and conducted to the stenosis, after which the balloon of the balloon catheter is inflated and the stenosis is expanded by using this inflation force.

Up to now, moreover, stents have been used in patients with stenoses in the bile duct or ureter, especially in inoperable cases. In particular, expanding stents have also come to be used recently.

These expanding stents are constituted by connecting wave-shaped cylinders which are formed from wires by a string.

[Problems Which the Utility Model Seeks to Solve]

However, there has been the problem that, when the stenotic parts of blood vessels, bile ducts, or ureters are expanded by introducing balloon catheters in the manner described above, cracks are formed in hard atheromas with advanced organization, so that blood flows through them.

Therefore, the effect of the operation does not last, and the blood vessel must be closed again after 5-6 months.

Recently, moreover, expanding stents have been used especially often. These stents, however, cannot be returned to their original states once they have been released from the catheter sheaths, because the two cylinders are connected by a string. Therefore, they have presented the problem that they cannot be moved if they are put into the wrong locations or there are other suitable places for them.

Moreover, there is the drawback that, if the affected part in which the stent is placed is bent, the stent is also placed in a bent state; therefore, occasions arise in which the connecting part of the stent is closed and the stent cannot play its role.

Therefore, the inventors discovered a stent structure such that an expandable stent can be recovered after it has been placed in a stenotic part of a blood vessel, and in addition, it can perform its action fully even when the affected part is bent. They perfected the present utility model based on this discovery.

Therefore, the first purpose of the present utility model is to provide a stent which can be recovered after it has been released from its catheter sheath.

A second purpose of the present utility model is to provide a recoverable stent which can perform the functions of a stent even when it is placed in an affected part with a pronounced curvature.

[Means of Solving the Problems]

These purposes of the present utility model are accomplished by a recoverable stent which is characterized by the fact that it consists of at least two cylinders formed by wave-shaped wires with their ends connected; the peaks and valleys of said wave-shaped wires have narrowed parts formed in them; the valleys of one of said cylinders are connected by wires to the peaks of the other cylinder; the connecting part of at least one of these peaks and valleys is engaged by a ring; and rings are formed in the outer peaks or valleys.

The make-up of the present utility model will be explained in detail below by means of an actual example, but the present utility model is not limited to this example.

Figure 1 is a perspective view of the stent of the present utility model which can be bent and recovered. In this stent, a wire 1 is formed into a wave shape which has narrowed parts 2 at the peaks of the waves, and the ends of the wave-shaped wires are connected to form a ring.

Next, two cylinders formed in this way, i.e., wave-shaped rings, are connected by using wires 6 which connect the valleys of one wave-shaped ring and the peaks of the other wave-shaped ring. These wires 6 have small rings 3 and are connected by engaging with the narrowed parts 2.

It is desirable for there to be 2 or more of these wave-shaped rings, but it is preferable for there to be 2 of them.

Moreover, it is desirable for the connections of the valleys of [one] wave-shaped ring with the peaks of the [other] wave-shaped ring to connect all of them.

Furthermore, in order to increase the inflating force of the stent, elastic narrowed parts 2 are formed in the valleys and peaks of the wave shapes.

The materials of the wires used in the present utility model are not particularly limited, as long as they are elastic. Examples of them are stainless steel wire, piano wire, elastic plastic wire, super-elastic metal wire, shape-remembering alloy wires, etc. In addition, it is necessary for the material to be somewhat pliable, since it must follow and adhere tightly to the blood vessel wall.

The diameter of the wire used is ordinarily in the range of 0.05 mm to 0.2 mm.

The stent of the present utility model is used by inserting it into a catheter sheath; when it is in use, a string is passed through all of the rings 4 at the rear of the stent. Preferably, a string is passed through all of the rings 4 in such a way that the string finally comes out from the ring through which the string was first passed; both ends of the string are passed into the catheter sheath so that they come out of its rear part, and the stent is placed in the catheter sheath in this state.

The length of the string should be amply longer than the length of the catheter sheath when it is doubled.

The stent which has been released from the catheter sheath expands rapidly and becomes a stent with an enlarged middle part; when one wants to move it to another place, both ends of the aforementioned string are pulled and the catheter sheath is recovered, after which the catheter is moved.

After this stent is placed in the desired place, the string is removed by pulling one end of it.

Since the stent of the present utility model is placed in blood vessels for long periods of time, it is desirable to apply an antithrombotic agent (e.g., heparin, urokinase, etc.; furthermore, an antithrombotic material such as hydroxy methacrylate-styrene copolymer can be used as a coating) to it so that clots do not adhere to it.

The catheter sheath used with the stent of the present utility model is not particularly limited; ones which are ordinarily used in this technical field may be used.

[Operation and Effectiveness of the Utility Model]

Since the peaks and valleys of the waves of the wave-shaped wire of the recoverable stent of the present utility model are connected to a wire which has small rings 3, the stent does not close up when it is placed in an affected part of a blood vessel, etc., which is bent. Furthermore, it can be recovered, if desired, and thus it can be moved to another place, which can increase its therapeutic effectiveness.

4. Brief Description of the Drawing

Figure 1 is a perspective view of the recoverable stent of the present utility model.

Explanation of Symbols

1 ... wave-shaped wire
2 ... narrowed part
3 ... small ring
4 ... ring
5 ... fixing and connecting part
6 ... wire with small rings

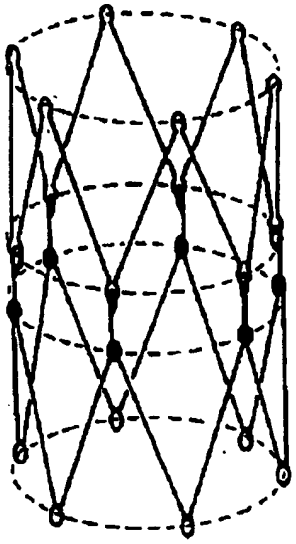

Figure 1